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Northeastern Forest Experiment Station



FOREST SERVICE, U.S. DEPT. OF AGRICULTURE, 6816 MARKET STREET, UPPER DARBY, PA. 19082

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A PERFORMANCE TEST OF THE LOG and TREE GRADES for EASTERN WHITE PINE

PROCUREMENT SECTION
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Abstract. — The results of testing the Forest Service standard tree grades and sawlog grades for eastern white pine on an independent sample of 75 trees and 299 logs in southwestern Maine. The total predicted value of the 75 trees was 3 percent higher than the actual value. The total predicted value of the 299 logs was 2 percent higher than the actual value. The differences between the actual and predicted values are small enough to be of no practical importance.

Standard log and tree grades for eastern white pine, developed by the Northeastern Forest Experiment Station, have been approved by the USDA Forest Service for use in all Forest Service activities where tree and log grades are needed. They have been recommended for use by timber and log buyers, sellers, and processors throughout the commercial range of eastern white pine.

The log and tree grades (figs. 1 and 2) were developed from grade-yield studies conducted in New England, the southern Appalachians, and the Lake States. Reports describing the grading systems show the expected lumber-grade yields by log grade and diameter class. These grade yields are necessary for estimating the value of the graded trees and logs in terms of standard yard lumber.

This note is a report on the results of test-

ing the adequacy of the grading systems and expected lumber grade yields on an independent sample of trees and logs in the New England area.

The Study

The 75 trees used in this study were selected from four different timber stands in southwestern Maine. They ranged from 60 to 120 years old. Diameter at breast height ranged from 12 to 28 inches. All the trees were measured and graded according to the standard tree grades. After felling, the trees were bucked into logs; and the logs were scaled and graded according to the standard sawlog grades. The 299 logs ranged from 6 to 24 inches in scaling diameter.

The logs were sawed into standard yard

EASTERN WHITE PINE SAWTIMBER TREE GRADE SPECIFICATIONS

GRADING FACTOR	TREE GRADE 1	TREE GRADE 2	TREE GRADE 3	TREE GRADE 4
(1) MINIMUM D.B.H. (inches)	10	10	10	10
(2) MAXIMUM WEEVIL INJURY IN BUTT 16 FOOT SECTION (number)	None	None	2 injuries	No limit
(3) MINIMUM FACE REQUIREMENTS ON BUTT 16 FOOT SECTION	Two full length or four 50% length good faces. ¹ (In addition, knots on balance of faces shall not exceed size limitations of grade 2 sections).	No GOOD FACES REQUIRED. Maximum diameter of knots on three best faces:	<p><i>SOUND RED KNOTS</i> not to exceed 1/3 scaling diameter and 5 inch maximum.²</p> <p><i>DEAD OR BLACK KNOTS</i> including overgrown knots not to exceed 1/6 scaling diameter and 2½ inch maximum.²</p>	Includes all trees not qualifying for GRADE 3 or better and judged to have at least one-third of their gross volume in sound wood suitable for manufacture into standard lumber.
		<p><i>SOUND RED KNOTS</i> not to exceed 1/6 scaling diameter and 3 inch maximum.²</p> <p><i>DEAD OR BLACK KNOTS</i> including overgrown knots not to exceed 1/12 scaling diameter and 1½ inch maximum.²</p>		
(4) MAXIMUM SWEEP OR CROOK IN BUTT 16 FOOT SECTION (percent)	20	30	40	No limit
(5) MAXIMUM TOTAL SCALING DEDUCTION IN BUTT 16 FOOT SECTION (percent)	50	50	50	No limit
<p>After the tentative grade of the section is established from face examination, the section will be reduced in grade whenever the following defects are evident:</p> <p>(6) <i>CONKS, PUNK KNOTS, AND PINE BORER DAMAGE ON BARK SURFACE OF SECTION:</i> Degrade one grade if present on one face. Degrade two grades if present on two faces. Degrade three grades if present on three or four faces.</p> <p>If the final grade of the grading section is 1, 2, or 3, examine the tree for weevil injuries in the merchantable stem above 16 feet. If the total apparent weevil injuries exceed three, degrade the tree one grade below the section grade.³ Otherwise the tree grade is the same as the final section grade.</p>				

¹ Trees under 16 inches d.b.h. require four full length good faces.

² Scaling diameter is estimated at the top of the 16 foot grading section.

³ No tree will be degraded below GRADE 4 unless net tree scale is less than one-third of gross tree scale.

Figure 1. — Eastern white pine tree grade specifications.

EASTERN WHITE PINE SAWLOG GRADE SPECIFICATIONS

GRADING FACTOR	LOG GRADE 1	LOG GRADE 2	LOG GRADE 3	LOG GRADE 4
(1) MINIMUM SCALING DIAMETER (inches)	14 ¹	6	6	6
(2) MINIMUM LOG LENGTH (feet)	10 ²	8	8	8
(3) MAXIMUM WEEVIL INJURY (number)	None	None	2 injuries ³	No limit
(4) MINIMUM FACE REQUIREMENTS	Two full length or four 50% length good faces. ⁴ (In addition, log knots on balance of faces shall not exceed size limitations of grade 2 logs).	No GOOD FACES REQUIRED. Maximum diameter of log knots on three best faces:		Includes all logs not qualifying for No. 3 or better and judged to have at least one-third of their gross volume in sound wood suitable for manufacture into standard lumber.
		SOUND RED KNOTS not to exceed 1/6 scaling diameter and 3 inch maximum. DEAD OR BLACK KNOTS including overgrown knots not to exceed 1/12 scaling diameter and 1½ inch maximum.	SOUND RED KNOTS not to exceed 1/3 scaling diameter and 5 inch maximum. DEAD OR BLACK KNOTS including overgrown knots not to exceed 1/6 scaling diameter and 2½ inch maximum.	
(5) MAXIMUM SWEEP OR CROOK ALLOWANCE (percent)	20	30	40	66-2/3
(6) MAXIMUM TOTAL SCALING DEDUCTION (percent)	50	50	50	66-2/3

After the tentative log grade is established from face examination, the log will be reduced in grade whenever the following defects are evident:

(7) **CONKS, PUNK KNOTS, AND PINE BORER DAMAGE ON BARK SURFACE⁵**

Degrade one grade if present on one face.

Degrade two grades if present on two faces.

Degrade three grades if present on three or more faces.

(8) **LOG END DEFECTS: RED ROT, RING SHAKE, HEAVY STAIN AND PINE BORER DAMAGE OUTSIDE HEART CENTER OF LOG⁵**

Consider log as having a total of 8 quarters (4 on each end) and degrade as indicated below:

Degrade one grade if present in 2 quarters of log ends.

Degrade two grades if present in 3 or 4 quarters of log ends.

Degrade three grades if present in 5 or more quarters of log ends.

¹ 12 and 13 inch logs with four full length good faces are acceptable.

² 8 foot logs with four full length good faces are acceptable.

³ 8 foot No. 3 logs limited to one weevil injury.

⁴ Minimum 50% length good face must be at least 6 feet.

⁵ Factors 7 and 8 are not cumulative (total degrade based on more serious of the two).

No log to be degraded below grade 4 if net scale is at least one-third gross log scale.

Figure 2. — Eastern white pine sawlog grade specifications.

lumber at a circular sawmill in southwestern Maine. The lumber was graded by a certified grader, using the white pine lumber-grading rules of the Northeastern Lumber Manufacturer's Association. Length, width, thickness, and rough green grade of each board were recorded by log number. Of the 26,325 board feet of lumber produced, about 80 percent was 4/4; the remainder was 6/4 and 8/4.

Because the lumber-grade yield tables in the published reports are based on dressed-dry volumes, conversion of the rough green lumber-grade volumes to dressed-dry volumes was necessary. Conversion ratios developed from the original white pine grade-yield studies, were applied to the green volumes. The resulting volumes, hereafter called actual volumes, were then summed to obtain the actual dressed-dry lumber-tally volumes for each tree and log. Actual value of the lumber from each tree and log was computed by multiplying current lumber-grade prices by the actual lumber-grade volumes.

Predicted volumes and values, to be used for comparison with the actual volumes and values, were computed from the published lumber-grade yield percentages and the total lumber-tally volume of each tree and log. Lumber-tally volume was used instead of scaled volume so that the analysis would not be complicated by the introduction of overrun factors. The predicted value of each tree and log was obtained by multiplying the same current lumber-grade prices by the predicted lumber-grade volumes.

Results and Discussion

Tree grades.—The predicted and actual values of each tree were summed and converted to value per 1,000 board feet lumber tally for each tree grade. The predicted value of the entire 75-tree sample was about 3 percent higher than the actual value (table 1). The predicted value of the 9 grade-1 trees was about 5 percent higher than the actual. The relative differences between predicted and actual values for the other three tree grades ranged from 1.4 to 3.5 percent (table 1).

The 5-percent difference in value of the grade-1 trees was caused primarily by the overestimation of the volume of select lumber. There are two reasons why this happened. First, the sample size was small (9 trees). Second, although the 9 trees met the specifications for grade 1, the majority were, by chance, low-line grade-1 trees.

The average difference between total predicted value and total actual value of the trees in each tree grade was computed and tested for significance by use of the t-statistic based on paired observations (table 1). Results showed that the average differences for grades 2 and 3 were not significant. The differences for grades 1 and 4 were significant. However, the actual magnitude of these differences was small enough to be of no practical importance.

Another measure of the performance of a grading system is how well the grades segregate the sample of trees into distinct value

Table 1. — *Actual and predicted values for each tree grade*

Tree grade	Trees	Total tree value		Mean difference	Value/1,000 board feet		Percent difference
		Predicted	Actual		Predicted	Actual	
	<i>No.</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Pct.</i>
1	9	427.94	407.78	2.24*	185.68	176.94	4.9
2	20	1,009.08	994.89	.71	162.89	160.60	1.4
3	22	1,276.29	1,243.21	1.50	144.33	140.59	2.7
4	24	1,198.37	1,157.71	1.69*	133.39	128.86	3.5
All grades	75	—	—	—	148.58	144.48	2.8

*Significant at 5-percent level.

Table 2. — Actual and predicted values for each log grade

Log grade	Logs	Total tree value		Mean difference	Value/1,000 board feet		Percent difference
		Predicted	Actual		Predicted	Actual	
	No.	Dollars	Dollars	Dollars	Dollars	Dollars	Pct.
1	10	296.12	274.17	2.20	216.98	200.89	8.0
2	32	562.75	558.43	.14	175.14	173.80	.8
3	182	1,942.08	1,898.95	.24*	146.04	142.80	2.3
4	75	1,079.64	1,071.84	.10	127.78	126.85	.7
All logs	299	—	—	—	147.41	144.48	2.0

*Significant at 5-percent level.

classes with a minimum of overlapping values between grades. The average value per 1,000 board feet of the grade-2 trees was about 9 percent lower than the value of the grade-1 trees; the value of the grade-3 trees was about 14 percent lower than that of the grade-2 trees; and the value of the grade-4 trees was about 9 percent lower than that of the grade-3 trees. The variability around the average value for each grade (coefficient of variation) ranged from 5 to 7 percent.

Log grades.— The predicted value of the 299-log sample was 2 percent higher than the actual value (table 2). As was the case with the tree-grade comparisons, the grade-1 logs had the largest difference (8.0 percent) between the predicted and actual value. Again, this larger difference was caused primarily by the overestimation of the volume of select lumber produced from the grade-1 logs. The differences between predicted and actual value for the other log grades ranged from 0.7 percent to 2.3 percent (table 2).

The average differences between total predicted and actual value were non-significant

except for log grade 3 (table 2). Even though the mean difference of grade-3 values was statistically significant, it was small enough to be of little practical importance.

The log-grade system segregated the sample logs into distinct value classes with a minimum of overlapping between grades. The average value per 1,000 board feet of the grade-2 logs was about 12 percent less than that of the grade-1 logs; the value of the grade-3 logs was about 19 percent less than that of the grade-2 logs; and the value of the grade-4 logs was about 10 percent less than that of the grade-3 logs. The coefficients of variation ranged from 9 percent to 12 percent within the four log grades.

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—BRISBIN, ROBERT L.
Research Forest Products Technologist
Northeastern Forest Experiment Station
Forest Service, U. S. Department of Agriculture
Upper Darby, Pa.

